Detailed description of the transformation process used in „ Can women detect cues to ovulation in other women's faces?" authored by Janek S. Lobmaier, Cora Bobst & Fabian Probst:

All manipulations described in the following were done with Psychomorph, a computer graphics software that was designed for morphing and transformation processes and is widely used by the community.

Building prototypes:

Two composite faces (= prototypes) were created using established computer graphic methods that have been widely used in studies of face perception (e.g., 1-8) Prototypes are morphs that are constructed by averaging the shape, color and texture of a group of faces, such as faces of women during ovulation and during the luteal phase of their menstrual cycle. The rationale here is that averaging a group of faces into one image reveals consistent characteristics of this group while characteristics that are not shared are averaged out.

Eighteen women consented to being photographed twice, once during their late follicular cycle phase (ovulation) and once during their luteal cycle phase. None of the women was using hormonal contraception. Photographs were taken not later than 24 hours after the peak of the luteinizing hormone (LH) and then again 7 days later in the luteal cycle phase. LH surge was determined by WH OvultellTM ovulation test strips. To further confirm that the women actually were in the corresponding cycle phase, they provided saliva samples at both sessions using a commercially available sampling device (Salivette; Sarstedt, Rommelsdorf, Germany) from which estradiol, progesterone and testosterone levels were assessed. The progesterone level of these 18 women was significantly lower at ovulation than during the luteal phase (ovulation: 25.63±13.36 pg/ml, luteal phase: 51.86±24.91 pg/ml; $t = -4.90$ $p < .001$, $d = -1.16$), estradiol levels however did not differ (ovulation: 3.76±1.55 pg/ml, luteal phase: 3.95±1.84 pg/ml; $p = .42$).

Prototypes were made using PsychoMorph computer graphics software (9). First, the shape of each face is determined by 178 facial landmark points, marking the shape and position of eyes and brows, nose, mouth, ears, cheekbones, chin, as well as the outer face shape. In a next step, all the pictures that were taken in one phase were morphed (i.e., averaged). In the resulting prototype, the position of each facial landmark is defined by the averaged position of the landmarks of the initial 18 pictures; hence the prototype of the woman in the luteal phase is the average of the individual 18 faces photographed in the luteal cycle phase, the prototype of the ovulatory woman is the average of the individual 18 faces photographed in the late follicular phase. It is important to note that each prototype contained the faces of the identical 18 women, the only difference being that each prototype (see Figure 1) consisted of 18 pictures of the same 18 women taken in different cycle phases.

Stimulus Transformation. Twenty (new) frontal portraits of female faces showing a neutral expression were selected from the LongevityFaceDatabase (10). These pictures are, at this stage, completely unrelated to the pictures used for the prototypes. Each face from the database, henceforth referred to as "stimulus face", was transformed (i.e. assimilated) in two steps (50% and 100%) towards the prototype of the female in the luteal phase and the prototype of the ovulatory female. In order to do this, for each stimulus face again the 179 facial landmarks were manually defined, just as it had been done for the pictures that were used for the prototypes. This shape can then be modified (shape transformation).

In the actual transformation process, landmark points' coordinates of the stimulus face were shifted towards the coordinates of the two prototypes by adding 50% (100%) of the linear 2D differences between the two prototypes to the stimulus faces (see 11). For each stimulus face we thus obtained two versions (50%; 100%) that were parametrically transformed towards the shape of the prototype of the woman in the luteal phase and two versions (50%; 100%) that were parametrically transformed towards the shape of the prototype of the ovulatory woman. It was a shape transformation only, hence the four versions of the same stimulus face differed in shape but not in colour, luminance or skin texture.

The magnitude of the spatial shift of the landmark point can be defined by the user by specifying the wanted percentage of transformation (we chose 50% and 100%). Note that even transformations of more than 100% are possible; this would end up in a sort of caricature (see 9 for technical details).

The resulting four transforms were paired in such a way that participants saw the two 50% transforms and the two 100% transforms simultaneously. Note that even the pictures of the pairs consisting of the 100% transforms were still very much alike (for an example see Figure 1b). Pairs were shown in both lateralizations: the ovulatory female was once on the right and once on the left half of the screen. Hence a total of 80 (2x2x20) face pairs were shown in each task.

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